

Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025
Upstream and Downstream Bioprocess Technology

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Explain the general requirements and techniques for plant and microbial cell culture in upstream processing. (10 Marks)
- b. Discuss the significance and types of fermentation modes (batch, continuous and fed-batch) in industrial bioprocessing. (10 Marks)

OR

- 2 a. Describe the steps involved in the strain improvement process and explain its impact on product yield. (10 Marks)
- b. Compare submerged and solid-state fermentation. Provide examples of products typically produced by each method. (10 Marks)

Module-2

- 3 a. Illustrate the microbial growth kinetics and describe the phases of microbial growth in a closed batch system. (10 Marks)
- b. Explain the optimization strategies for increasing product yield during fermentation. (10 Marks)

OR

- 4 a. Discuss the criteria for process design when producing high-volume, low-value versus low-volume, high-value products. (10 Marks)
- b. Describe factors that affect the production of secondary metabolites and discuss their industrial applications with examples. (10 Marks)

Module-3

- 5 a. Discuss the challenges and essential requirements in Downstream Processing (DSP) for by-product purification. (10 Marks)
- b. Describe the cell disruption methods for intracellular product recovery, including mechanical and non-mechanical techniques. (10 Marks)

OR

- 6 a. Compare and contrast various centrifugation techniques (ultracentrifugation and differential centrifugation) used in DSP. (10 Marks)
- b. Explain extractive separation and its application in bioprocessing. (10 Marks)

Module-4

- 7 a. Describe the principles of ion exchange and affinity chromatography, and their applications in bioproduct purification. (10 Marks)
- b. Explain the factors influencing solute polarization and cake formation in membrane ultrafiltration. (10 Marks)

OR

- 8 a. Illustrate the working principle of reverse osmosis and discuss its use in bioprocess applications. (10 Marks)
b. Discuss the design and configuration of membrane separation equipment. (10 Marks)

Module-5

- 9 a. Explain the considerations involved in scaling up a bioprocess from lab to industrial scale. Include a discussion on equipment and instrumentation adjustments. (10 Marks)
b. Describe the key economic and regulatory aspects (QC/QA, GLP, GMP) relevant to bioprocess industries. (10 Marks)

OR

- 10 a. Discuss the methods and challenges in effluent treatment, specifically in the context of aerobic and anaerobic treatments. (10 Marks)
b. Explain the recovery and purification processes for bioproducts, focusing on techniques such as filtration, centrifugation and drying. (10 Marks)

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